



## **2013 Groundwater Level Summary**

### **City of Bainbridge Island Groundwater Management Program**

This summary is a provisional examination of groundwater levels measured monthly by the City's Groundwater Management Program (GMP). Water level data are used to assess the quantity of water in Island aquifers to ensure a sustainable supply of drinking water.

Through monitoring and the use of Early Warning Levels (EWLs), the City is able to identify potential developing impacts for further investigation. *Safe yield* is the amount of water that can be withdrawn from an aquifer without causing adverse effects. The early warning level for safe yield is defined as *a declining rate of ½ foot per year or more over a 10-year period that cannot be explained by the seasonal precipitation variations.*

Should water level data indicate an exceedance of the EWL, appropriate management responses would be implemented as detailed in an excerpt from the City's *Groundwater Monitoring Program – Program Update* (December 2008, revised March 2009) provided at the end of this report. The document in its entirety can be found on the City's webpage in the GMP library at <http://www.bainbridgewa.gov/175/Groundwater-Monitoring-Program>.

This is a provisional summary only. The City hopes to have a more in-depth, hydrogeological assessment in the near future of additional continuous level monitoring and production data and to test possible management actions using the City's numerical model of the Island's aquifer system.

The GMP has monitored water levels in Island aquifers since 2007 and currently measures water level in 46 public and private wells. These data are presented, by aquifer, in Figures 1 – 4 at the end of this report.

Cumulative Rain Departure (CRD) is a measure of how much actual rainfall either exceeded or fell below the average rainfall. Since nearly all of the groundwater recharge (replenishment) on the Island comes from rainfall, comparing water level elevation changes to the CRD is useful in assessing whether variations in groundwater levels are due to rainfall (or lack thereof), or some other influence such as overuse. The CRD is included in Figures 1 - 4.

Under natural conditions, very wet periods or above average rainfall will cause groundwater levels to rise. Likewise, drought years or other periods of *below* average rainfall will cause groundwater levels to decline.

Since infiltration and recharge (or replenishment) rates can vary depending upon local geology and the depth of the aquifer, water levels and CRD will likely not be an exact match, but they should both be rising and/or falling at approximately the same time.

In general, water levels in all aquifers appeared to remain steady or varied in accordance with changes in rainfall. None of the monthly monitored wells demonstrated water level declines in exceedance of the EWL.

The GMP's monthly monitoring network does not include any wells in the deepest aquifer, the Fletcher Bay Aquifer. These deep wells are predominantly production wells or municipal monitoring wells operated by the City's Water Utility or other public water purveyor such as the Kitsap Public Utility District. Data from the deep wells were examined for comparison to monthly monitored data, but are not provided here. It is anticipated that the potential future in-depth hydrogeological assessment will include a thorough examination of these data sets along with production data.

## ***4 Early Warning Levels and Management Responses***

### ***4.1 Overview***

*For the purpose of the GMP, an EWL is a monitoring criteria that, if exceeded, would result in appropriate Management Responses. Responses would be of two types: (1) additional investigations in order to determine if a potential problem is developing, and (2) protective or remedial actions where appropriate. Possible investigations could include additional data evaluation, expanded monitoring, problem specific technical review and analysis, or modeling. Possible actions may include water conservation, limitations on new wells, or development of alternate water supplies.*

*The purpose of specifying EWLs is to provide quantifiable measures for initial evaluation of data that will provide timely warning of a developing issue before a problem becomes acute. Provisional Early Warning Levels were developed in the initial Groundwater Management*



Program report (Aspect, 2006b) and are modified below. The reader is referred to the 2006 report for additional information on the development of provisional EWLs.

The purpose of Management Responses is to provide the City with a structure of appropriate and sequential monitoring and investigative activities that would lead, if necessary, to protective or remedial actions. The emphasis at this time is on the monitoring and investigative activities.

## **4.2 Early Warning Levels**

### **4.2.1 Safe Yield**

The EWL for safe yield is a long-term drop in water level that is not attributable to seasonal or year-to-year variations in precipitation. For quantitative comparison, **a decline rate of ½ foot per year or greater over a 10-year period** is considered cause for follow-up responses.

A useful tool is comparison of well hydrographs with the (CRD) departure curve (Section 3.1.1). Water levels that do not rise during wet periods or that decline during periods of near average precipitation would be cause for concern. Evaluation of potential impacts from long-term water level declines is best addressed through a numerical groundwater model.

## **4.3 Management Responses to Exceedances of EWLs**

### **4.3.1 Water Level**

An EWL for safe yield is proposed as a decline of ½ foot per year or greater over a 10-year period for drops in water level unexplained by seasonal or year-to-year variations in precipitation.

If water level data for a well indicate exceedance of the EWL, the following Management Responses are recommended: Confirmation and characterization of a problem and identification and implementation of protective or remedial actions.

**1. Confirmation and characterization** of a safe yield problem will require the following steps:

- Analyze the data on an aquifer basis by comparing well hydrographs within the aquifer and with the CRD curve;
- Compare hydrographs with production data and acquire additional production and chloride data as necessary;
- Determine the area of impact by water level observations in other nearby wells and calculation of the zone of contribution;
- Consider addition of monitoring wells to the existing network; and
- Evaluate long-term impacts with the groundwater model.

**2. Identification and implementation of actions** for aquifer protection will be necessary for situations where continued withdrawals indicate that mining of the aquifer is occurring. Possible actions include additional focused monitoring or groundwater modeling, water metering, water conservation, limitations on well drilling, development of water system interties, and/or development of alternate water supplies.

*Monitoring data and modeling results would be used to evaluate the effectiveness of different proposed actions. To identify the most appropriate actions, the City should disseminate information to the public and affected parties, enter into discussions with primary purveyors, encourage water conservation, and notify Washington State DOH, Kitsap Health Department, and Ecology. If necessary, regulatory responses could be considered in order to implement recommended protective or remedial actions.*

## Perched Aquifer CoBI Monthly Monitoring Wells

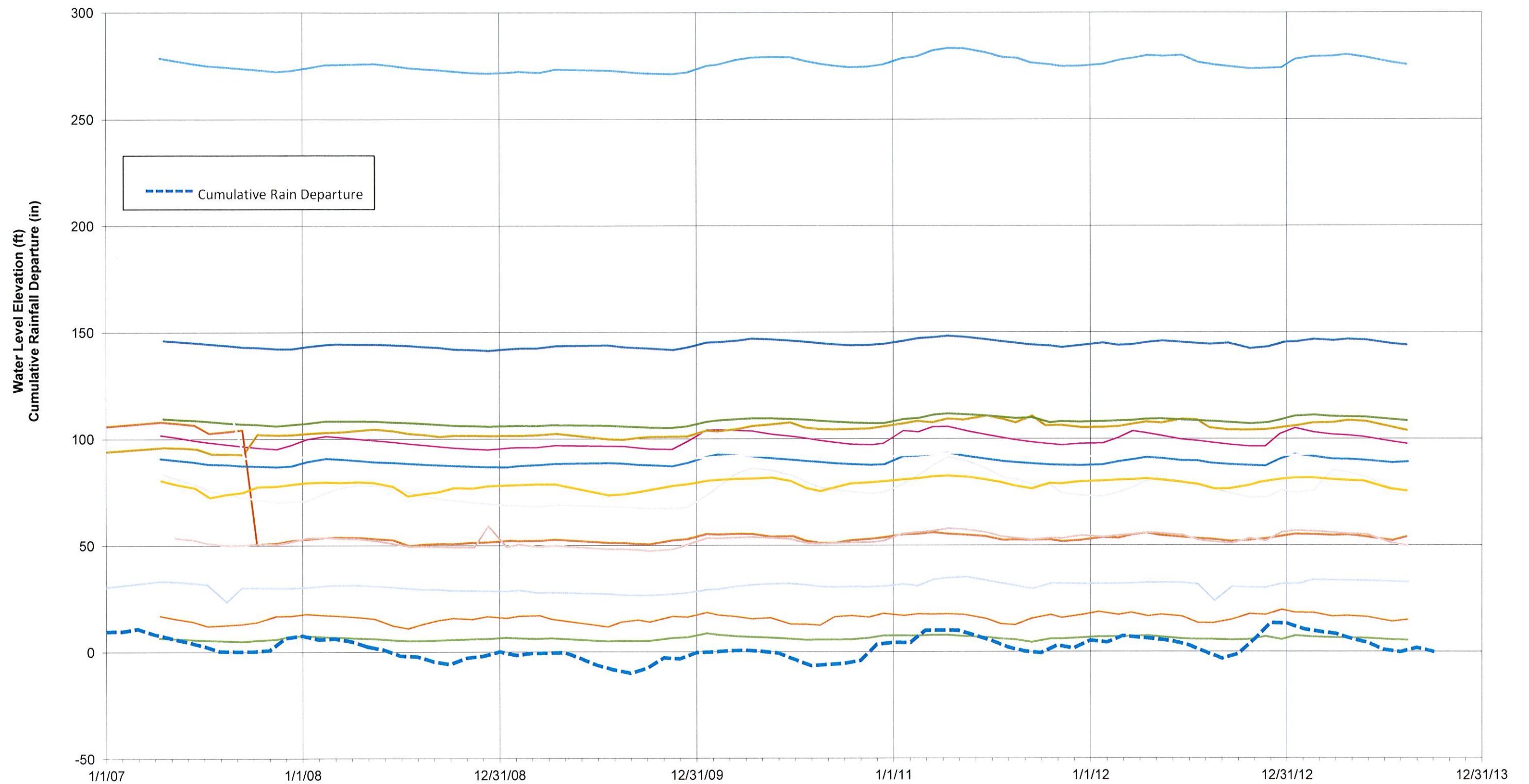




Figure 2

Semi-Perched Aquifer  
CoBI Monthly Monitoring Wells

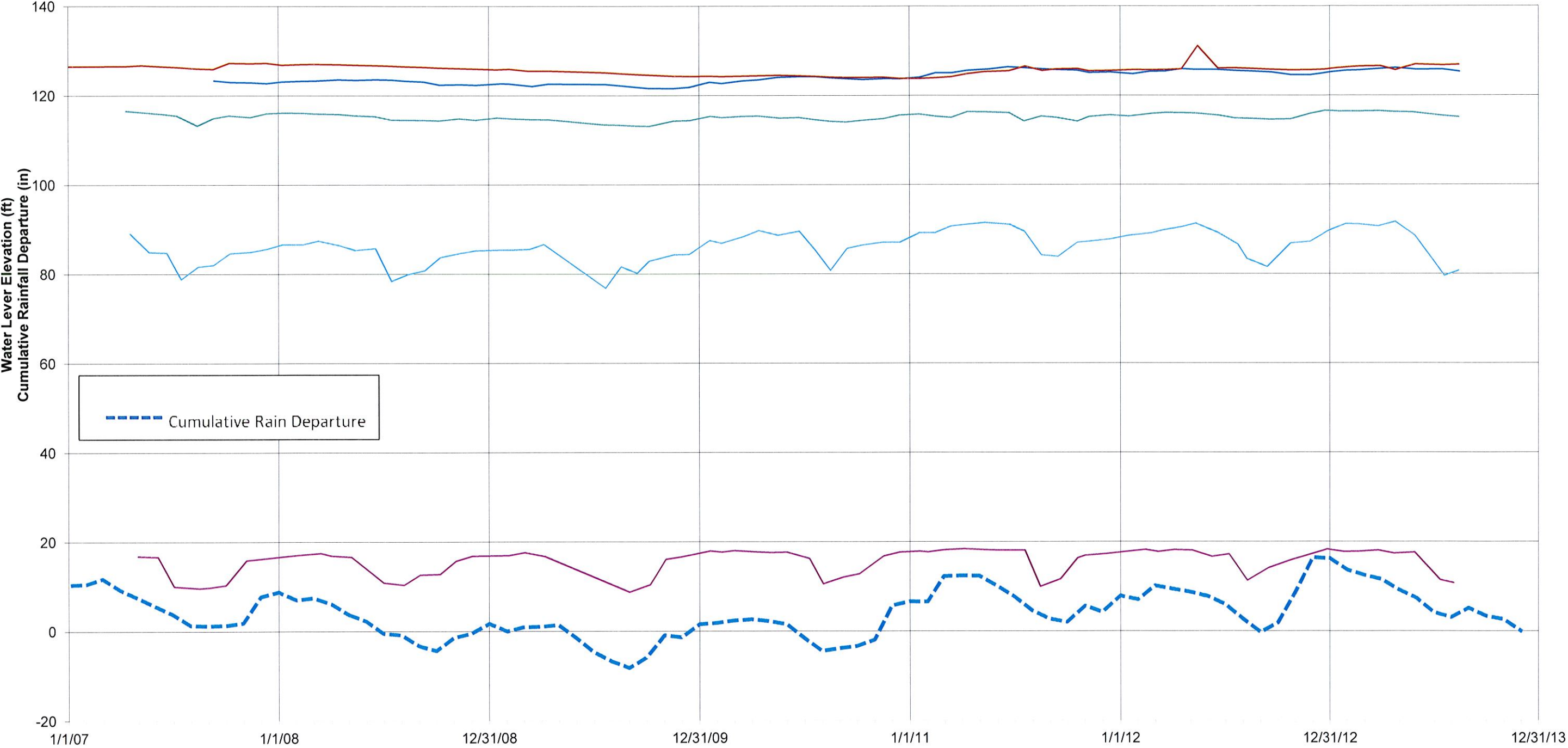


Figure 3

Sea Level Aquifer  
CoBI Monthly Monitoring Wells

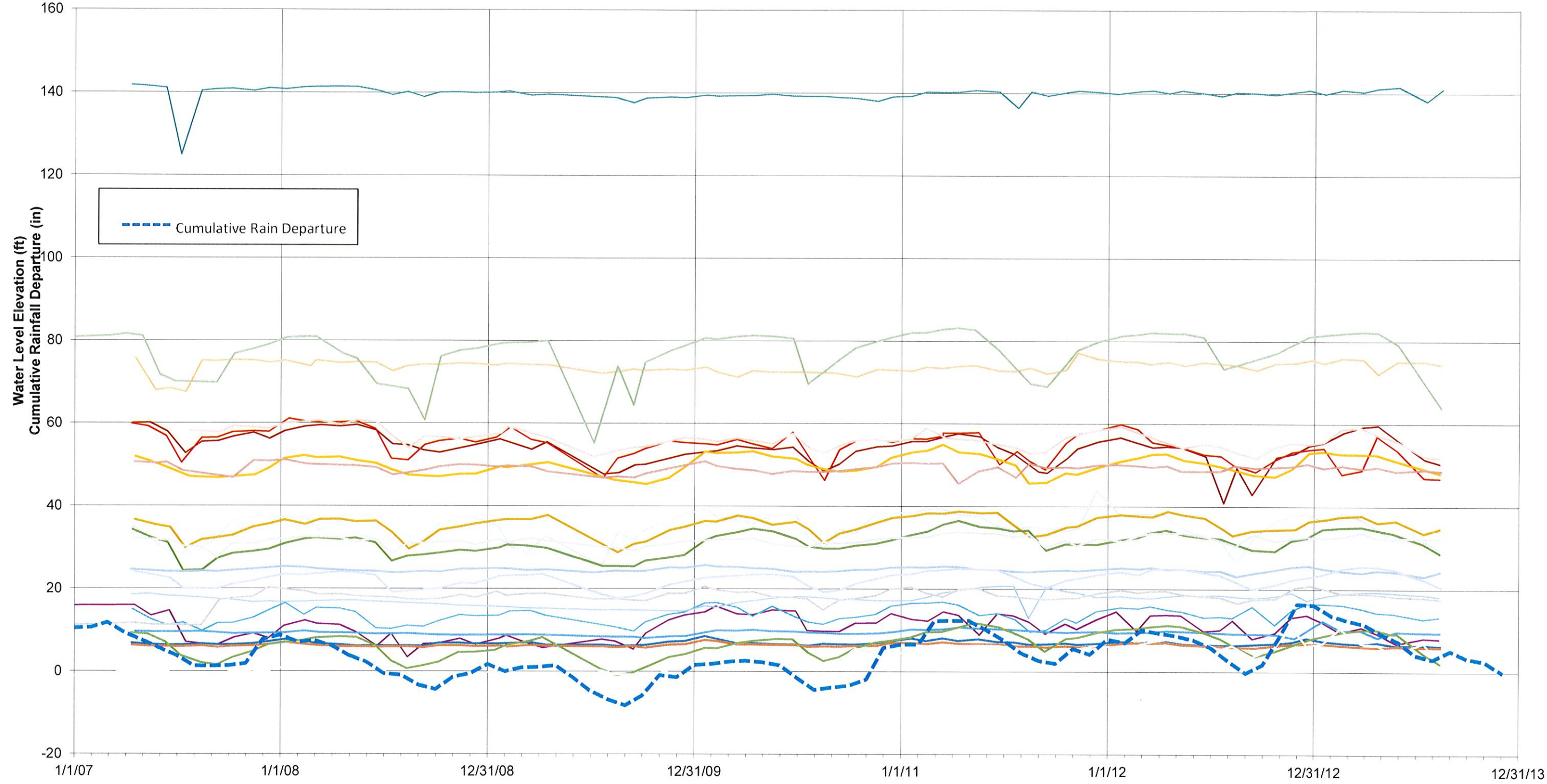


Figure 4

Glaciomarine Aquifer  
CoBI Monthly Monitoring Wells

